Biological Science in Kenai Fjords

Photograph courtesy of Alaska SeaLife Center

Live Feed Video Monitoring of Harbor Seals

By Anne Hoover-Miller, Shannon Atkinson, and Peter Armato

Only a century ago, the Kenai Fjords were in the grip of the Little Ice Age, the most recent widespread glacial advance in the North Pacific. Glacial encroachments into the fjords created unique and dynamic habitats abutting the faces of tidewater glaciers. Those habitats continue to be renowned for concentrations of harbor seals, sea otters, Kittlitz's murrelets, and shrimp.

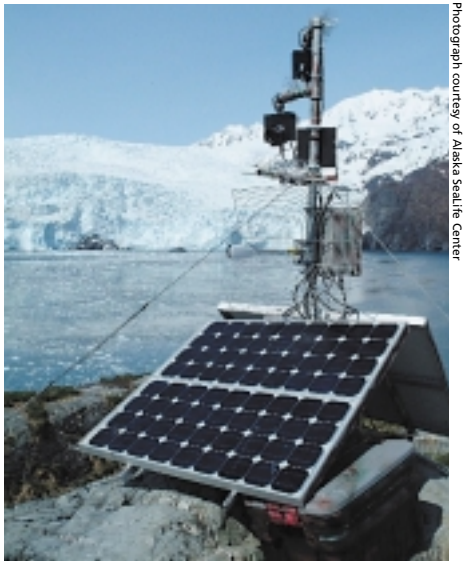
Harbor seals, the common seal of beaches, mudflats, and rocky shores throughout the North Pacific, are distinguished for living within diverse coastal environments *(Figure 1)*. Throughout their range, their populations have shown resilience despite the encroachment of humans and shoreline development. Recent warming trends, however, have set in motion new ecological events that, in the Gulf of Alaska, are affecting some haulout substrates. Although an icon of ecological adaptability, harbor seals in the Kenai Fjords are facing challenges that radically affect their survival.

Twenty-six years ago an abrupt climatic shift in the western Gulf of Alaska was postulated to have precipitated a major reorganization of the marine community structure *(Anderson and Piatt 1999)*. Shrimp-dominated communities, prevalent during the early and mid-1970s, were replaced by cods and flatfish. Simultaneously, population sizes of many seabird and marine mammal populations plummeted. Numbers of harbor seals decreased by as much as 90% in some areas *(Pitcher 1990)*. Although the changes in numbers of seals have been

(Left) Figure 1. Harbor seal on glacial ice in upper Aialik Bay.

(Opposite page) Dr. Shannon Atkinson and Anne Hoover-Miller at the Aialik Glacier video camera site in Kenai Fjords National Park.

Photograph courtesy of Alaska SeaLife Center



Photograph courtesy of Alaska SeaLife Center

Figure 3. Powered by solar panels and wind-driven generators, three camera stations transmit signals between upper Aialik Bay and the Alaska SeaLife Center.

attributed to many factors, including the climate-regime shift and subsequent nutritional stress, the actual mechanisms resulting in lower numbers of seals remains a mystery.

Despite the cold and protected features of glacial ice habitats, harbor seals in Kenai Fjords National Park did not escape environmental factors affecting other Gulf of Alaska seal populations. In 1980 more than 1,600 seals, including 350 pups hauled out on the ice near Aialik Glacier *(Hoover 1983)* *(Figure 5)*. By 1989, only 269 seals, including 92 pups were counted *(Hoover-Miller 1989)*. During the next decade numbers of seals remained low, with fewer than 300 seals and about 40 pups counted each year *(Tetreau 1998)*. Although numbers of seals in offshore waters near Kodiak Island have been increasing since 1993 at a rate of 6.6% per year *(Small et al. 2003)*, those in Aialik Bay have not *(Figure 2)*.

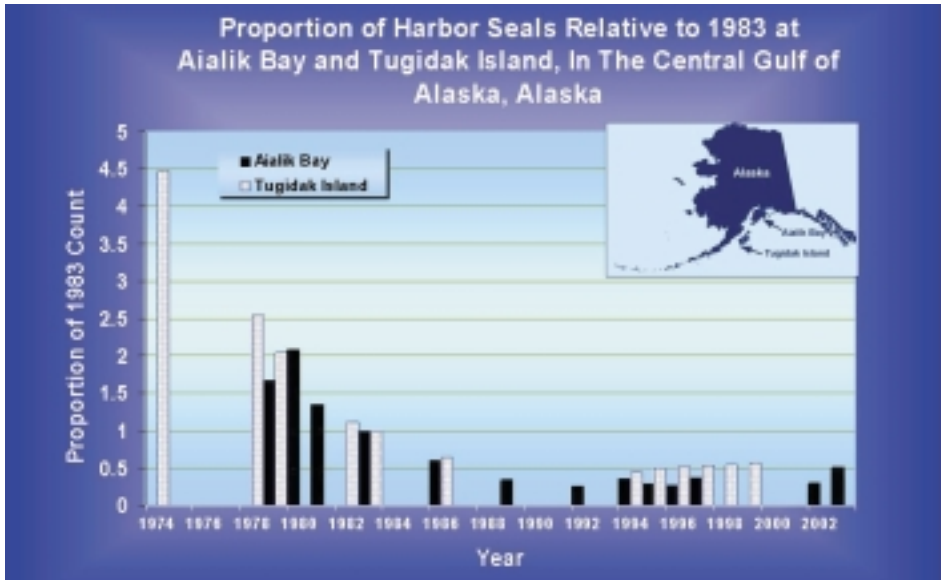
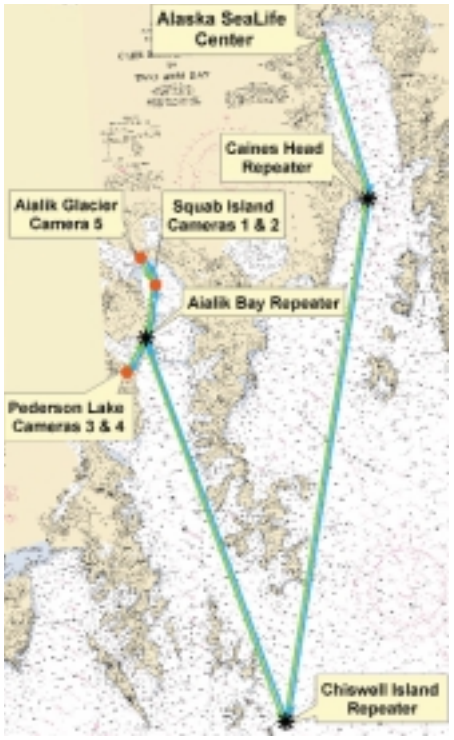


Figure 2. Relative rates of population decline of harbor seals at two locations in the Gulf of Alaska: Tugidak Island, near Kodiak Island, and in Aialik Bay, in Kenai Fjords National Park.

In 2002, the Alaska SeaLife Center (ASLC), in partnership with the National Park Service through the Ocean Alaska Science and Learning Center (OASLC), initiated a study of harbor seals in Aialik Bay using remotely-controlled video cameras to observe seals floating on the glacial ice. Video cameras, developed by SeeMore Wildlife Inc., have been placed at three locations for observing seals at Pedersen and Aialik Glaciers *(Figure 3)*. Powered by solar panels and wind-driven generators, the system consists of three camera stations assisted by three repeaters needed to transmit the signals 100 km between upper Aialik Bay and the Alaska SeaLife Center. The cameras with 25x optical zoom are controlled by personnel at the ASLC, and video signals are received and recorded on time-lapse video tape. Video images are used for documenting harbor seal population dynamics, haulout behavior, and interactions between vessels and seals.



Map of cameras and repeaters used for harbor seal study.

Harbor seals on ice

Newborn young of harbor seals are exceptionally precotial. Unlike most seals and sea lions, whose young may not enter the water until a month or two old, harbor seal pups shed their wooly lanugo coat before they are born and begin swimming within an hour of birth. Pups and their mothers typically are inseparable prior to weaning. This mobile strategy allows harbor seals to use haulouts that may be available only during limited tidal stages and weather conditions; it also permits lactating seals to forage, and aids pups in developing swimming and foraging skills.

In contrast to waters surrounding land haulouts typically used by harbor seals, waters within tidewater glacial fjords are especially cold (37-39ºF / 3-4ºC in spring), steeped with ice, and are strongly influenced by silt-laden fresh water discharged by both the glaciers and drainage from the steep watersheds surrounding the fjords *(Gay and Armato 1998)*. The first plunge of newborn pups in ice-infested waters is an energetic challenge, but the ability to swim soon after birth is critical. Glacial ice is always on the move and melting ice often

becomes unstable and may roll or break apart within hours. Although ice is replenished by the glacier's calving, seals often must swim more than a dozen kilometers just to compensate for the day's drift.

Ice availability also is affected by weather conditions. In 1979, strong northwesterly winds blew for four days during peak pupping. With the exception of a few seals observed using rocks and islands as haulout sites, the remainder of the seals apparently stayed in the water. Calls of swimming pups were heard throughout the upper bay. Pup mortality appeared high that year with frequent sightings of pups without their mothers and low numbers of mother-pup pairs *(Hoover 1983)*.

Glacial Lakes

Glacial lakes are specialized glacial ice habitats also used by harbor seals. Unlike the tidewater glacial ice habitats of fjords, where ice movements are unconstrained, glacial lakes lie at the bases of glaciers, but are separated from marine systems by stream outflows. Salinity levels within the lakes are regulated by the reach of tides with some lakes being estuarine while

Vessel congestion at wildlife viewing areas and associated disturbances of marine mammals precipitated local tour vessel operators to establish voluntarily vessel operating guidelines. Marine mammal viewing guidelines were developed and adopted in 2000-2001 to minimize the impact of tour vessel operations on wildlife and enhance viewing opportunities for multiple vessels throughout the day

Photograph courtesy of Alaska SeaLife Center

Figure 4. Tours to tidewater glaciers in Kenai Fjords National Park provide visitors with opportunities to view actively calving glaciers and wildlife associated with tidewater glaciers.

Photograph courtesy of Alaska SeaLife Center

View of Aialik Glacier.

Photograph courtesy of Alaska SeaLife Center

Figure 5. Harbor seals were abundant on glacial calved ice during the early 1980s.

others may be free of marine influence. Stream entrances, usually cut through moraine deposits, restrict tidal flows into the lake as well as the drift of ice out of the lake. These lakes have only recently been recognized as an important habitat for harbor seals.

The lake abutting Pedersen Glacier, currently provides haulout habitat for approximately 200 harbor seals. Unlike Aialik Glacier, which is used by pupping and molting seals, Pedersen Lake is used primarily in mid-summer and fall by molting seals. The trapped ice within the lake provides a more reliable habitat for seals to haul out on, but infrequent glacial activity results in low rates of ice replenishment.

Cameras installed at Pedersen Lake provide a glimpse into the life of seals in a remote, secluded environment. Movements of seals in and out of the estuarine lake are restricted to higher tidal stages when water levels are sufficiently high for them to swim the shallow stream. Once in the lake, the seals are trapped until the tides release them.

Vessel Disturbance

With the establishment of Kenai Fjords National Park in 1980, a new environmental change was set in motion. Once a location visited by a few commercial fishermen and the occasional recreational boater, upper Aialik Bay has now become a primary destination for park visitors. Currently more than 75,000 people travel by vessel, ranging in size from 100-foot tour-vessels to small kayaks, to visit glacial haulouts in Aialik Bay and neighboring Northwestern Fjord. Aboard the vessels, visitors have the opportunity to view calving tidewater glaciers and observe seals, sea otters, and other wildlife resting on the floating ice *(Figure 4)*.

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Baseline studies in 1979 and 1980 documented low vessel traffic, usually only one to two vessels per day in the upper bay. Few of those vessels entered the ice or interacted with the seals. By 1996, multiple vessels visited glacial face sites on a daily basis. In 1996, the NPS observed seals during a 12-day period at two fjords within the park. Twenty-eight vessels entered ice affected areas. Of those, 13 vessels (46%) caused major disturbances, where at least 20 seals abandoned the ice, and a total of 16 vessels (57%) caused at least one seal to enter the water *(Tetreau 1996)*.

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During 2002, researchers at the ASLC observed 64 interactions between vessels and harbor seals. Of those interactions, 58% resulted in no seals entering the water, 30% resulted in fewer than six seals entering the water, and 5% caused interactions where more than 20 seals entered the water. Observations taken the following year documented 89 interactions between vessels and harbor seals. Of those, 82% caused no seals to enter the water, 10% caused fewer than six seals to enter the water, and 8% caused at least 20 seals to enter the water. The decreased frequency of disturbances appears to be primarily the result of improved vessel operating practices adopted by local commercial vessel operators. Continued reduction of incidences causing seals to enter the water in 2003 coincided with more conservative vessel operations in conjunction with a greater awareness of the cameras and the ongoing study.

Currently, harbor seals are facing strong selective pressures to adapt to rapidly changing environmental conditions. Many seals have not coped well; however, ongoing studies will aid researchers in identifying environmental parameters critical for seals. With this information, management practices that mitigate adverse effects from anthropogenic activities within the fjords can be developed, and continued monitoring will enhance our understanding of how successfully seals are adjusting.

More information on this research and the harbor seals of the Kenai Fjords can be found at http://www.alaskasealife.org/site/research/science_programs/harborseals

Photograph ©Bob Hoover

View of upper Aialik Bay.

REFERENCES

Anderson, P.J. and J.F Piatt. 1999. *Community reorganization in the Gulf of Alaska following ocean climate regime shift.* Marine Ecology Program Series 189:117-123.

Gay, S.M. III and P.J. Armato. 1998. *Hydrography of McCarty Fjord, Northwestern Fjord and Aialik Bay, Kenai Fjords National Park, Alaska.* Report from pilot study submitted to Kenai Fjords National Park.

Hoover, A.A. 1983. *Behavior and ecology of harbor seals (Phoca vitulina richardsi) inhabiting glacial ice in Aialik Bay, Alaska.* M.Sc. Thesis. University of Alaska, Fairbanks.

Hoover-Miller, A.A. 1989. *Impact assessment of the T/V Exxon Valdez oil spill on glaucous-winged gulls in the Kenai Fjords National Park, 1989.* Report to the National Park Service, Seward, Alaska.

Hoover-Miller, A.A. 1994. *Harbor seals (Phoca vitulina): Biology and Management in Alaska.* Report to the Marine Mammal Commission. Contract Number T75134749. Washington, D.C.

Pitcher, K.W. 1990. *Major decline in number of harbor seals, Phoca vitulina richardsi, on Tugidak Island, Gulf of Alaska.* Marine Mammal Science 6:121-134.

Small, R.J., G.W. Pendleton, and K.W. Pitcher. 2003. *Trends in abundance of Alaska Harbor seals, 1983-2001.* Marine Mammal Science 19(2):344-362.

Tetreau, M. 1998. *Harbor seal decline studied in Kenai Fjords National Park.* Park Science 18(1):4.